

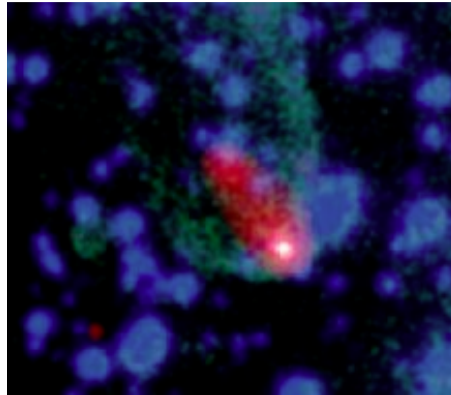


Black Widow pulsar spraying antimatter into space

Friday, 28 February 2003

A fast-spinning stellar predator, dubbed the Black Widow pulsar, has been found have a cocoon of high-energy particles and spraying matter and antimatter particles into space, astronomers have discovered.

This is the first direct evidence that such a cocoon exists around a pulsar, astronomers said in a study published in today's issue of the journal, *Science*, using data obtained with the Chandra X-Ray Observatory, in an elliptical orbit around Earth.



A composite image of the pulsar, showing an elongated cocoon of high-energy particles flowing behind it (Pic: Chandra)

"This is the first detection of a double-shock structure around a pulsar," said Dr Benjamin Stappers, of the Netherlands' Organisation for Research in Astronomy in Dwingeloo, who led the study. "It should enable astronomers to test theories of the dynamics of pulsar winds and their interaction with their environment."

The pulsar, formally known as B1957+20, the Black Widow got its nickname because the high-energy cosmic radiation it emits is destroying its companion star. The pulsar completes one rotation every 1.6 thousandths of a second, and belongs to a class of extremely rapidly rotating collapsed stars known as millisecond pulsars.

It is also travelling through the galaxy at a speed of almost a million kilometres per hour, creating a bow shockwave that is visible to optical telescopes. But the Chandra images show what cannot be seen in visible light: a second shock wave created from pressure that sweeps the wind back from the pulsar to form the cocoon of high-energy particles, visible for the first time.

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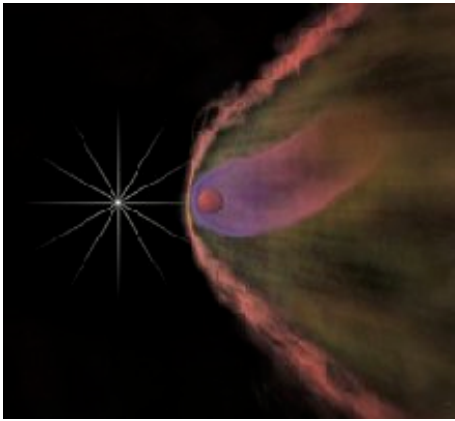
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Artist's impression of the pulsar (left) blasting its spinning companion
(Pic: M.Weiss, Chandra)

"This star has had an incredible journey," said Assistant Professor Bryan Gaensler, an Australian astronomer at the Harvard-Smithsonian Centre for Astrophysics in Boston who co-authored the study. "It was born in a supernova explosion as a young and energetic pulsar, but after a few million years grew old and slow and faded from view."

"Over the next few hundred million years, this dead pulsar had material dumped on it by its companion, and the pulsar's magnetic field has been dramatically reduced. This pulsar has been through hell, yet somehow it's still able to generate high-energy particles just like its younger brethren," he said.

The Black Widow is a rotating neutron star, a dense ball of super-compressed matter left over after a supernova explosion. Even among neutron stars, the Black Widow is something special: a twirling body called a millisecond pulsar that keeps spinning faster by pulling material off its companion.

The steady push of the matter drawn into the pulsar keeps spinning it ever faster, much as pushing a merry-go-round makes it go more quickly. The Black Widow, which is probably about a billion years old, is about 5,000 light-years away from Earth. A light-year is about 10 trillion km, or the distance light travels in a year.

Wilson da Silva - ABC Science Online

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